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ABSTRACT

Variations in classroom instruction were observed, and related to student achievement in reading and mathematics. A six-construct model was applied to data on students and instructional practices in sixty second grade classrooms at nine geographic sites, seven of which were sponsored by Project Follow-Through. The constructs were: (1) initial cognitive ability of the students, (2) opportunity to learn criterion material, (3) motivators supporting student learning, (4) curriculum structure, (5) quality of instructional events, (6) end-of-year student achievement on the math and reading subtests of the Metropolitan Achievement Test. Two of the three major instruments in the Classroom Analysis Package (CAP)--the Teacher Interview/Questionnaire and the Verbal Instructional Behaviors coding scheme--and a videotape of teacher behavior in the classroom provided data on instructional practices. The results of the data analysis are presented in two stages: variance in end-of-year student achievement using (1) the first five constructs as predictors and (2) selected measures of the CAP as predictors. The construct model contributes to teacher effectiveness and evaluation research because it identifies which practices seem relevant for which gains, rather than simply stating that one program is more successful than another. (CP)

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Applying a Classroom Process Model to Instructional Evaluation

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APPLYING A CLASSROOM PROCESS MODEL TO INSTRUCTIONAL EVALUATION[1]

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Abstract

The purpose of this study was to examine dimensions of classroom processes that affect student learning in reading and mathematics. Using a model of classroom processes, instruments were developed to assess each major construct specified by the model. Data were reduced and analyzed in a way that permitted contrasts to be made between those instructional practices that affect achievement in reading and mathematics. Results indicate that the model's constructs can be successfully used to assess the classroom environment for both reading and mathematics instruction.

APPLYING A CLASSROOM PROCESS MODEL TO INSTRUCTIONAL EVALUATION

Over the past 15 years, educational researchers have placed special emphasis on the generation of information that contributes to the improvement of educational practices. Evaluative researchers in particular have focused their attention on the identification of specific programs that provide effective instruction. Much of this research has focused on the acquisition of basic skills in the context of compensatory education. The results to date have been somewhat discouraging, with little evidence accumulating to indicate that school differences make a difference in student performance. Part of the problem has been that "program" has been considered a single variable that was expected to be powerful enough to make a significant difference (Edwards, Guttentag, & Snapper, 1975). This research assumes that there are a variety of instructional features, many of which are shared by different programs, that will most probably affect educational outcomes.

The purpose of this study is to observe and relate the variations in classroom instruction in both reading and mathematics to variations in student achievement in those subjects. Within that broad statement of purpose are

several sub-objectives: (a) to measure the major instructional dimensions along which classrooms can be expected to vary, including, but not limited to, teacher behaviors; (b) to relate variation in specific classroom processes to variation in reading and mathematics achievement; and, (c) to contrast the observed patterns of results in a manner that will reveal whether similar practices result in higher achievement levels in both subjects or whether there are noticeable differences between subjects indicating the need for different models for each subject.

Background

This study has roots in both teacher effectiveness research and evaluative research. Early research on teacher effectiveness focused on simple descriptions of differences among teachers and assumed the value of one type of behavior over another (Flanders, 1967). However, teacher effectiveness research has begun to focus more attention on the relationship between specific patterns of teacher behavior and student academic growth (Rosenshine, 1971, 1976). Recent work has also underscored the necessity of examining teacher behavior in the context of the total instructional environment (Cooley, Leinhardt & McGrail, 1976). The current study benefits from the efforts of these researchers to limit the behaviors of concern and to

concentrate on those behaviors that appear to have pay-off in terms of student growth.

Evaluative research, especially educational evaluation, has also experienced significant growth. Initial work assumed that simple black box contrasts of outcomes would be sufficient to evaluate different educational programs (Tatsuoka, 1972). However, evaluators soon realized the necessity of including information about educational treatments, as well as outcomes, in their models (Stake, 1967; Lindvall & Cox, 1970; Stufflebeam, 1971; Cooley, 1971). Efforts to accomplish this task were often frustrated by large amounts of highly intercorrelated descriptive data and weak tools for incorporating these data into some comprehensible analysis (Leinhardt, 1974; Stallings, 1975). These experiences led to the identification of two problems: (a) the need for a conceptual scheme to guide both data collection and analysis; and, (b) the need for reasonable analysis procedures. The solution to the first problem lies with the application of a current model of classroom process. A partial solution to the second problem is discussed later.

This paper represents an application of a model for the evaluation of classroom processes. This model was initially described by Cooley and Lohnes (1976) and was further expanded by Cooley and Leinhardt (1975). The model consists of six constructs: two student performance constructs and

four classroom process constructs. The student performance constructs include initial and end-of-year student behaviors -- in this case performance on standardized tests. The classroom process constructs consist of: (a) the motivators that support student learning, (b) the opportunity to learn criterion material, (c) the structure of the curriculum, and, (d) the quality of the instructional events (Cooley & Leinhardt, 1975). The constructs are operationally defined by a set of variables for each construct and a set of measures for each variable. The constructs can be used to organize data post hoc (Leinhardt, in press; Stallings, 1975) or, preferably, they can be used to generate, select, and organize variables and measures for analysis. This study is of the second type.

Data Source

The data were collected in 60 second grade classrooms at 9 geographical sites during the 1974-1975 school year. Seven of the sites were under Follow Through sponsorship; two were not. The sites were located throughout the U.S., in both urban and rural settings, and the student composition varied from being predominately black to predominately white. All of the classrooms were using some version of the Learning Research and Development Center's individualized curricula.[2]

Data were obtained on the students and on instructional practices. Initial student performance levels were assessed by using the raw scores from the Lorge-Thorndike Cognitive Abilities Test (CAT) (Thorndike, Hagen, & Lorge, 1968) administered in early fall to all students. Final student performance levels were assessed by using the raw math and reading subtests of the Metropolitan Achievement Test (MAT) (Durost, Bixler, Wrightston, Prescott, & Balow, 1971), which were administered in May to all students.

The data on instructional practices were obtained from an early version of the Classroom Analysis Package (CAP). Two of the three major instruments in CAP were used for this study: the Teacher Interview/Questionnaire (TIQ) on classroom processes and characteristics, and the Verbal Instructional Behaviors (VIB) coding scheme for teacher-student interactions.[3] The TIQ was administered twice during the school year, in November and in March; the educational specialist,[4] with the help of the teacher, responded to it. In order to obtain information on teaching behaviors in classrooms, videotapes were made by the educational specialist twice during the year, in November and in March. A total of one hour of tape was collected for each classroom, one half hour of math and one half hour of reading.

Coding

The videotapes were coded using the VIB. This procedure yielded information about the following aspects of a teacher's verbal behavior: the frequency of interactions, the content of interactions, the affect of interactions, and to whom the interactions were directed. The coding yielded 36 measures, covering primarily the instructional event aspect of the model. In the current study, some of these were combined or deleted for a variety of reasons, such as infrequent occurrence.

The TIQ was coded and yielded information on 57 measures. These measures covered all four constructs of the model. For the current study, some measures were deleted or combined. Figures 1-4 list all of the measures used for reading and math processes as well as the constructs to which they were assigned.

The inter-rater reliability (percent agreement) for videotape coding was 89.38 across all categories with a range of 82.79 to 95.38. The intra-rater reliability was 92.96 (range 91.29 - 95.17) for one rater and 90.65 (85.17 - 97.92) for the other.

Analysis

Traditionally, the analysis of classroom process data has faced multiple problems (Leinhardt, 1976; Cooley & Leinhardt, 1975; Resnick & Leinhardt, 1975). The purpose of the analysis is either to describe classroom practices or to explain the observed variation in end-of-year student performance by combining information about initial student performance and classroom practices. Two major difficulties are common when the latter purpose is sought: (a) an overabundance of predictor variables in the face of limited sample size; and, (b) high intercorrelations between initial student behaviors and classroom practices and among classroom practices (multicollinearity).

There are many approaches available for the reduction of data. The one most frequently used and recommended is to use principle component analysis and a rotation procedure on the measures and combine them to create factor scores for each construct. This technique has the advantage of producing a set of orthogonal variables, within a construct, that is easily used in further analyses such as multiple regression. Experience trying this produced several problems, however: (a) the factor loadings do not replicate well; (b) the factors themselves are very hard to interpret; and, (c) important measures within the construct that are not correlated with other measures in the same construct are not incorporated into the factors. This last

problem is the most serious. It arises from the fact that measures of educational processes, even within a construct, are not expected to be equivalent to a homogeneous set of items on a test.

In this study, factoring procedures were not used. Instead, all of the measures were transformed to standard scores (zero mean and unit variance), then the measures within a variable, within a construct, were combined by simple addition (math and reading process sets were combined separately as noted in the figures). Those measures expected to negatively influence achievement were reflected before combining them.

Insert Figure 1 about here

The measures used to form each of the variables are shown in Figures 1-4. The first construct, opportunity is shown in Figure 1. The opportunity "score" of a classroom consists of the sum of the measures within Figure 1 for that particular classroom. Opportunity consists of two variables: time available to learn material, and the relationship between material taught and material tested. However, in this sample the curricula were the same, so only the first variable was used. A "good" or high score would

be obtained if a particular room has: (a) few teacher absences; (b) many student days in school; (c) small enrollment; (d) high attendance; (e) the chance for students to start work immediately rather than when the teacher tells everyone start together; (f) more minutes actively spent in mathematics; and, (g) few student transfers in or out of the class during the school year.

Insert Figure 2 about here

The motivators score of a classroom consists of the sum of the measures within variables in Figure 2 for a given classroom. A high score would be obtained if a teacher: (a) uses additional books for reading; (b) uses games and texts for mathematics; (c) does not wait until the next day to correct work, but returns work quickly; (d) provides a chance for cognitive exploration and spends time that way; (e) lets students decide what materials to use, when to stop work, or when to work in teams; (f) does not let students decide which subject to study, when to take a test, or whether to work alone; and, (g) lets students score their own tests, uses peer tutoring, and uses praise. A classroom is considered motivating if it effectively uses curricular and interpersonal motivators.

Insert Figure 3 about here

The structure and placement score of a classroom consists of the sum of the measures within variables in Figure 3 for a given classroom. A high score would be obtained if the teacher: (a) informally assesses student abilities in reading and math; (b) does not make up tests in reading and math (but uses those provided in the curriculum); (c) assigns reading and math work individually (uniquely); (d) gives blocks of work in reading and math; (e) tests students frequently for purposes of assignments; (f) tests children on material they learned (individualized testing) and obtains a high passing rate; and, (g) uses the curriculum sequence rather than a teacher-developed one. The use of curriculum tests and sequence rather than teacher-developed tests would be expected to be a "good" practice only if the curriculum was a well specified and carefully developed one. A classroom is considered "good" if it has and uses appropriate procedures for matching students with the curriculum and sequences the instruction carefully.

Insert Figure 4 about here

The instructional events score of a classroom consists of the sum of the measures within variables in Figure 4 for a given classroom. A high score is obtained when the teacher: (a) does not make many managerial or cognitive-managerial type statements to individuals (or groups) in reading or math; (b) does talk about personal or extended material in reading while refraining from it in mathematics; (c) makes cognitive statements and questions to individuals in reading and math; (d) does not address groups as groups while covering cognitive material in reading (no occurrence in math) either by statements or questions; (e) does not have children initiate (call out) reading or mathematics responses; (f) does not spend extended time with one student or lecture to the whole class in either reading or math; (g) has a high ratio of cognitive to managerial contacts in reading and math; (h) interacts with many different individual children as opposed to groups in reading and math; (i) does not have a lot of "dead" time (silences); (j) focuses the student's attention; (k) asks students if work is correct; (l) reminds students of previous work; (m) manages the class smoothly; (n) individualizes instruction; (o) gives extra homework but does not repeat material or continue when

student fails; and, (p) uses supplementary materials, peer tutoring or contacts parents when the student makes no progress, but does not skip material or randomly change approach. A classroom is considered to have "good" instructional events if the content is academically focused, comments are directed towards individuals, and appropriate instructional procedures are used.

Summing the transformed variables in this way limits the set of predictor variables and substantially reduces the intercorrelations among the set. Once the data were reduced, a modification of regression analysis was used to predict student achievement. The particular analysis employed was commonality analysis (Mood, 1971; Kerlinger & Pedhazur, 1973; Veldman, 1975; Cooley & Lohnes, 1976). This approach was used because it helps to present a clearer picture of the unique explanation of variance by a particular construct (or variable) as well as the combined explanation of variance by more than one construct (or variable).

Results

The results of the commonality analysis will be discussed in two stages. First, the overall results of the analysis using five constructs to predict one will be presented for reading and mathematics achievement. Second,

the results of an analysis using the variables within constructs will be presented for both reading and mathematics.

Insert Table 1 about here

Contributions of Constructs to Student Achievement

Initial results of the commonality analysis indicate that the total end-of-year achievement variance explained by the classroom model is similar for reading and mathematics (74 and 72 percent respectively). However, there are slight differences between reading and math that are revealed by a closer examination of the data. As shown in Table 1, initial student ability explains 62 percent of the variance in end-of-year reading performance, 49 percent of which is unique to initial ability and 13 percent of which is shared with the instructional variables. The combined (the sum of the uniqueness plus in common effects of process alone) instructional variables explain 11 percent of the end-of-year variance in reading, independent of initial ability. The motivators and instructional events constructs are slightly more important in terms of explaining unique variance than the other process constructs; however, opportunity, motivators, and instructional events are all

important when one considers the total (unique and confounded) variance explained.

Table 1 also displays the correlations and partial correlations (with initial abilities partialled out) by construct for reading achievement. Looking at the last row of the partial correlation, one can see that motivators, structure and placement, and instructional events all influence student achievement in reading in a positive way. Opportunity to learn is also important; however, as a construct, it is the most confounded with initial student performance. This is consistent with previous findings (Leinhardt, 1974, in press).

Insert Table 2 about here

In mathematics, on the other hand (see Table 2), initial ability explains 57 percent of the end-of-year performance, 43 percent of which is unique and 14 percent of which is shared with instructional variables. Instructional variables together account for 14 percent of the end-of-year variance in mathematics achievement, independent of initial ability. In mathematics achievement, three of the constructs, motivators, structure, and instructional event, are somewhat more important than opportunity in terms of

explaining unique variance in performance. Opportunity, as a construct, is confounded with initial student performance, motivators, and instructional events so that its unique contribution is low but the total contribution is not. Thus, while the overall picture is similar for both math and reading, it appears that mathematics achievement is especially influenced by those instructional practices that deal with the motivators, degree of structure in the curriculum, and the quality of the instructional event.

Table 2 also displays the correlations and partial correlations, by construct, for mathematics achievement. Looking at the last row of the partial correlation matrix, it appears that all four constructs are important to student achievement in mathematics. Opportunity to learn is again confounded with initial student performance, but less than with the analyses for reading. As with the reading data, the motivators to learn have the greatest influence on student achievement.

Considering the positive influence of the constructs on achievement, it seems worthwhile to examine them in greater detail. In spite of using the same techniques, the results of such an analysis must be considered in an exploratory and descriptive way, as 53 classrooms are insufficient for more definitive discussion.

Insert Table 3 about here

Contributions of Variables within Constructs to Student Achievement

Table 3 displays the results of the commonality analysis for reading achievement using the variables within constructs as predictors. A general review of the analysis indicates the following. In this sample, curricular motivators exert a more powerful influence than interpersonal ones. Within the construct of structure and placement, matching seems to be more important than sequencing. However, this should be viewed cautiously, as all of the classrooms were ostensibly using the same curricula. Therefore, one would expect greater consistency in the sequencing of instruction and the potential for greater differences among teachers in matching and assignment behaviors. Within the instructional event construct, teacher experience is more potent than the estimates of teacher behavior. It is hoped that as we improve our capacity to measure the important aspects of teachers' behaviors, experience itself will no longer be as important (Leinhardt, 1974), but will be reflected in what experienced teacher's do that is different from inexperienced teachers.

The partial correlations in Table 3 are also revealing. We can see, for example, that teacher experience, while a strong predictor of student achievement, is also related to the opportunity to learn material. It might be that experienced teachers have the influence to obtain brighter children, smaller classes, limited transfers, and are themselves absent less frequently. Table 3 also shows that interpersonal motivators and curriculum sequence are somewhat weak predictors. As noted before, the content of teachers' statements and the instructional procedures are related quite strongly to student achievement in reading.

Table 4 displays the results of the commonality analysis for mathematics achievement, using the variables within constructs as predictors. The pattern for math is similar to that of reading. In this sample: (a) the curricular motivators are more important than interpersonal ones; (b) within the structure and placement construct, matching is more potent than sequencing; (c) within the construct of instructional events, experience and procedures are more important than content and direction; and, (d) the variables, content and direction of teachers' statements, and sequence of instruction, are confusing--apparently, negative commonalities result in smaller total contributions than unique contributions.

The partial correlations for the instructional events construct also show a weak relationship between the first variable in the construct and achievement, but a slightly stronger one for the other two variables, procedures and experience. The partial correlation points up even more dramatically the significance of the matching variable and the two motivator variables in affecting student achievement. The opportunity available to learn material (column 2) is confounded both with initial abilities and teaching experience prior to having initial abilities partialled out, and, as with reading, it remains confounded with experience afterwards. This, of course, affects the unique contribution of opportunity (and experience) in explaining achievement.

In considering these results, it is important to bear in mind the information contained in Figures 1-4. For example, the opportunity and motivators constructs are made up of measures that are common for both reading and math (in the figures, this is indicated by an MR in parentheses). The structure and placement and instructional events constructs, on the other hand, use measures in common as well as parallel information. Parallel information indicates that the same information, for example, percentage of unique assignments, was obtained for both reading and math, but the information was based on the specific subject area. (In the figures, this is indicated by labeling.)

Discussion

In this set of classrooms, it is clear that providing opportunity to learn material, motivators to encourage learning, and appropriate instruction is facilitating in both reading and mathematics. Of particular relevance is the apparent fact that those facets of the instructional environment that are applicable to both reading and math (opportunity and motivators, primarily) are as important to growth as those facets that reflect potentially different practices for each subject area (structure and placement and instructional events, primarily). It is also interesting to note that even though the classrooms were all using the same curricula, sufficient variation exists in the implementation of the programs to differentiate among them and point up the relevance of appropriate matching and student assignment techniques.

This paper has sought to demonstrate the utility of employing a model of classroom processes for the evaluation of instructional practices. The outcome of such an exercise is not a statement of which of several programs (or implementations of a single program) are more effective, but which practices seem most relevant for which gains. The advantages to using this approach for instructional evaluation lie in the types of information that are generated. Rather than simply stating that this program is

more successful than another, the most significant dimensions of the instructional environment can be identified. By relating specific dimensions to specific outcomes, programs that maximize these dimensions can be selected and/or developed.

Further research is needed on: (a) the development and refinement of measures; (b) larger, more varied samples; and, (c) a variety of valued outcomes. For example, student progress or gain should be examined as an outcome as well as replicating the study using criterion-referenced measures to assess outcomes. It is possible that different dimensions are more relevant for student growth (e.g., curriculum progress) or for criterion-related performance than for obtaining higher levels of achievement on standardized tests.

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Footnotes

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[2] The basic characteristics of the LRDC instructional model are that: (a) it provides an environment that is adaptive to the educational needs of the student; (b) the curricula are organized and presented in a way that attempts to teach and reinforce basic cognitive skills; and, (c) the student directs and controls his or her own learning within the context of the curriculum. Operationally, this means that specific subject-matter areas are broken down into units and objectives that are hierarchically sequenced in a curriculum. In mathematics, placement tests, curriculum-embedded tests (CETs), and posttests are constructed for each unit so that students can be initially placed in the curriculum and so that their success in learning the material can be continuously monitored. Using the information provided by these tests, prescriptions are written for each student on a daily, weekly, or monthly basis. The classroom normally has one teacher and one

assistant or aide for 25 children. Usually, the teacher and assistant both circulate (travel) around the room during the work period; sometimes one will circulate while the other administers or corrects tests or tutors small groups. While circulating, the teacher or assistant corrects the work being done, occasionally alters prescriptions, offers brief tutorial assistance, and supports the student emotionally and academically. In general, the morning is divided into a work period in which assignments are prescribed and an exploratory period during which the children investigate curriculum-related material on their own. Classrooms vary in the degree to which students control the decision points in their daily learning situation, such as: which subject to study and when, which assignment to do first, when and when not to work on formal curricula, when to take a posttest, when to change units, and so on.

[3] The instruments in the CAP are available in Cooley, W. W., & Leinhardt, G. Design for the individualized instruction study: A study of the effectiveness of individualized instruction in the teaching of reading and mathematics in compensatory education programs. Final report to the National Institute of Education, Contract No. 400-75-0071, 1975.

[4] Educational Specialist is the individual(s) at the local site who is responsible for implementing the program.

Table 1
Commonality Analysis for Reading Achievement by Construct
N=53 R^2=.74

	Unique	Common	Total
Initial abilities	.49	.13	.62
Opportunity	.008	.14	.15
Motivators	.02	.13	.15
Structure & Placement	.008	.01	.02
Instructional Events	.03	.04	.07

Correlations Among Constructs in Commonality Analysis

		1	2	3	4	5	6
1	Initial abilities	x					
2	Opportunity	.28	x				
3	Motivators	.18	.38	x			
4	Structure & Placement	-.07	.04	.30	x		
5	Instructional Events	.03	.10	.15	.30	x	
6	Reading Achievement	.79	.39	.39	.15	.26	x

Partial Correlations Among Constructs in Commonality Analysis

		2	3	4	5	6
2	Opportunity	x				
3	Motivators	.35	x			
4	Structure & Placement	.06	.32	x		
5	Instructional Events	.10	.15	.30	x	
6	Reading Achievement	.28	.40	.34	.39	x

Table 2
Commonality Analysis for Math Achievement by Construct
N=53 R^2=.72

	Unique	Common	Total
Initial abilities	.43	.14	.57
Opportunity	.007	.13	.14
Motivators	.03	.14	.17
Structure & Placement	.02	.10	.12
Instructional Events	.02	.02	.04

Correlations Among Constructs in Commonality Analysis

		1	2	3	4	5	6
1	Initial abilities	x					
2	Opportunity	.23	x				
3	Motivators	.16	.28	x			
4	Structure & Placement	.13	.08	.36	x		
5	Instructional Events	-.08	.29	.17	.11	x	
6	Outcomes	.75	.37	.41	.35	.19	x

Partial Correlations Among Constructs in Commonality Analysis

		2	3	4	5	6
2	Opportunity	x				
3	Motivators	.25	x			
4	Structure & Placement	.05	.34	x		
5	Instructional Events	.32	.19	.12	x	
6	Math Achievement	.30	.45	.39	.37	x

Table 3
Commonality Analyses for Reading Achievement by Variable
R^2=.76 N=53

Construct	Variable	Unique	Common	Total
Initial Ability	Input	.42	.20	.62
Opportunity	Time	.002	.15	.15
Motivators	Curricular	.02	.16	.18
	Interpersonal	.003	.03	.03
Structure and Placement	Matching	.006	.01	.02
	Sequence	.000	.008	.008
Instructional Event	Content & Direction	.007	.02	.03
	Procedures	.005	.04	.05
	Experience	.02	.14	.15

Correlations and Partial Correlations for Variables in Commonality - Reading

Correlations

		1	2	3	4	5	6	7	8	9	10
1	Input	x									
2	Time	.28	x								
3	Curricular	.26	.34	x							
4	Interpersonal	.02	.23	.06	x						
5	Matching	-.06	-.04	.13	.23	x					
6	Sequence	-.07	.25	.22	.19	.43	x				
7	Content & Direction	.00	.00	.09	.00	.27	-.03	x			
8	Procedures	.00	.14	.13	.16	.31	.21	.45	x		
9	Experience	.23	.43	.18	.21	.09	.16	.04	.14	x	
10	Read	.79	.39	.42	.17	.15	.09	.18	.21	.39	x

Partial Correlations

		2	3	4	5	6	7	8	9	10
2	Time	x								
3	Curricular	.29	x							
4	Interpersonal	.23	.05	x						
5	Matching	-.03	.16	.23	x					
6	Sequence	.28	.24	.20	.43	x				
7	Content & Direction	.00	.09	.00	.27	-.03	x			
8	Procedures	.15	.13	.16	.31	.21	.45	x		
9	Experience	.39	.13	.21	.10	.18	.04	.14	x	
10	Read	.28	.36	.24	.32	.23	.29	.35	.35	x

Table 4
Commonality Analysis for Math Achievement by Variable
R^2=.74 N=53

Construct	Variable	Unique	Common	Total
Initial Ability	Input	.36	.21	.57
Opportunity	Time	.005	.13	.14
Motivators	Curricular	.02	.11	.13
	Interpersonal	.01	.04	.05
Structure and Placement	Matching	.02	.12	.14
	Sequence	.001	.xx	.00
Instructional Event	Content & Direction	.003	.xx	.001
	Procedures	.02	.05	.07
	Experience	.007	.14	.15

Correlations and Partial Correlations for Variables in Commonality - Math

Correlations

		1	2	3	4	5	6	7	8	9	10
1	Input	x									
2	Time	.23	x								
3	Curricular	.20	.16	x							
4	Interpersonal	.02	.24	.05	x						
5	Matching	.16	.07	.15	.27	x					
6	Sequence	-.05	.03	.15	.19	-.05	x				
7	Content & Direction	-.15	.22	-.02	.15	-.05	.04	x			
8	Procedures	.03	.16	.10	.11	.22	.15	.20	x		
9	Experience	.23	.38	.23	.21	.12	.15	.24	.14	x	
10	Math	.75	.37	.36	.23	.37	.01	.03	.26	.39	x

Partial Correlations

		2	3	4	5	6	7	8	9	10
2	Time	x								
3	Curricular	.12	x							
4	Interpersonal	.24	.04	x						
5	Matching	.03	.12	.26	x					
6	Sequence	.05	.16	.19	-.05	x				
7	Content & Direction	.26	.01	.15	-.03	.04	x			
8	Procedures	.16	.10	.11	.22	.15	.21	x		
9	Experience	.34	.20	.21	.09	.17	.28	.13	x	
10	Math	.30	.32	.33	.38	.07	.23	.36	.33	x

Figure 1
Selected measures from the CAP - Opportunity

Variables	Measures[1]
Time	# Days teacher was absent (-MR)[2]
	# of student days in school (MR)
	Total enrollment (-MR)
	% present (MR)
	Teacher starts students together (-MR)
	Minutes per day of active math (M)
	# transfer in (-MR)
	# transfer out (-MR)

[1] The following measures were deleted from this analysis because confounding with initial student abilities in this sample made them ambiguous predictors of student achievement: minutes per day in school, time scheduled for reading and math, active reading, number of days in school year.

[2] A minus sign indicates that measure was reflected in combining the measures because it was something that was considered to have a negative impact on achievement. M and R refer to the fact that the measure was used for either math, or reading criteria.

Figure 2
Selected measures from the CAP - Motivators

Variables	Measures[1]
Curricular Motivators	Reading modes - additional books (R)
	Math modes - text (M)
	Math modes - games (M)
	Work corrected the next day (-MR)
	How soon is work returned (0 = immediately, 5 = within a week) (-MR)
	There is an exploratory time (MR)
	The amount of exploratory time (MR)
Interpersonal Motivators	The student decides: materials to use (MR)
	subject to study (-MR)
	when to take test (-MR)
	when to stop work (MR)
	to work alone (-MR)
	to work in teams (MR)
	Student scores own tests (MR)
	There is peer tutoring (MR)
	Teacher uses general praise (MR)

[1]The following measures were deleted from this analysis because confounding with initial student abilities in this sample made them ambiguous predictors of student achievement: interest rating of material, work corrected same day or immediately, group contests, student decides where to sit, and contingent praise. The following measures were deleted because of the infrequency with which they occurred: negative contacts made by teachers during reading and math to individuals or groups.

Figure 3
Selected measures from the CAP - Strucuture and Placement

Variables	Measures[1]
Matching of students and curriculum	Teacher informally assesses student initial abilities in reading (R)
	Teacher informally assesses student initial abilities in math (M)
	Teacher constructs own tests in reading (-R)
	Teacher constructs own tests in math (-M)
	Percent of unique reading assignments (R)
	Percent of blocked reading assignments (R)
	Number of days since the last reading test (-R)
	Percent passing the last reading test (R)
	Percent of unique math assignments (M)
	Percent of blocked math assignments (M)
	Number of days since the last math test (-M)
	Percent passing the last math test (M)
Sequencing of Instruction	Teacher uses own reading sequence (-R)
	Teacher uses own math sequence (-M)

[1]The following measures were deleted from the analysis because confounding with initial abilities, or zero variance in this sample, made them ambiguous predictors of student achievement: ratings of reading and math structure, curricular tests of initial abilities in reading and math were used, the clarity of the next reading and math units, teacher skips around in sequence. Many other measures from the TIQ were not even obtained because of the examination of only one program.

Figure 4
Selected measures from the CAP - Instructional Events

Variables	Measures[1]
Instructional content and direction	Teacher management statements to individuals in reading (-R)
	Teacher cognitive management statements to individuals in reading (-R)
	Teacher cognitive management statements to small groups in reading (-R
	Teacher other statements in reading (R)
	Teacher cognitive statements to individuals in reading (R)
	Teacher cognitive statements to small groups in reading (-R)
	Teacher cognitive questions to individuals in reading (R)
	Teacher cognitive questions to small groups in reading (-R)
	Child initiates a reading contact (-R)
	The ratio of reading cognitive to management contacts (R)
	Teacher and student silences in reading (-R)
	Reading cognitive contacts to new individuals (R)
	Reading cognitive contacts to different groups (-R)
	Teacher management statements to individuals in math (-M)
	Teacher cognitive management statements to groups in math (-M)
	Teachers other statements to groups (-M)
	Teacher cognitive statements to individuals in math (M)
	Teacher cognitive questions to individuals in math (M)
	Student initiated responses in math (-M)
	The ratio of math cognitive to management statements (M)
	Teacher silences in math (-M)
	Teacher cognitive contacts to new individuals in math (M)
	Teacher focuses student's attention (MR)
	Teacher asks student if work is correct (MR)
	Teacher refers to earlier success (MR)
	Teacher manages the class well (MR)

Figure 4 (cont'd)

Variables	Measures
Instructional procedures	Teacher spends extended time in individual reading contact (-R)
	Teacher spends extended time in lecturing in reading (-R)
	Teacher spends extended time in individual math contact (-M)
	Teacher is individualized in instruction (MR)
	If the student fails, s/he: continues on (-MR)
	gets extra homework (MR)
	repeats same material (-MR)
	If the student makes no progress, s/he: uses supplementary material (MR)
	skips material (-MR)
	peer tutored (MR)
	changes approach (-MR)
	parents are contacted (MR)
Experience	Years of experience (MR)

[1]The following measures were deleted from this analysis because confounding with initial student abilities in this sample made them ambiguous predictors of student achievement: if fail give special work, if no progress tutor, math managements group, math cognitive managements individual, math cognitive statements to the whole class. The following measures were deleted from this analysis because of infrequency of occurrence, lack of variability, or redundancy with another measure: read managements group, read and math responses individual and group, errors in reading and math, drill in math, seeking active responses, modeling responses, tutorial rating, use of feedback. All other lack of symmetry between math and reading measures is due to non-occurrence.